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PETROGRAPHY OF ROCK SPECIMENS FROM THE STRIPA AND WESTERLY GRANITIC PLUTONS,
 USED FOR TESTING THERMAL PROPERTIES AT HIGH PRESSURES

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Project ERP-4.4.0.3.0.1
Underground Nuclear Waste Repository

8 pp

ENERGY RESEARCH PROGRAM
MINERAL SCIENCES LABORATORIES
DIVISION REPORT ERP/MSL 82-87(TR)

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CONTENTS

	<u>Page</u>
INTRODUCTION	1
PROCEDURE AND RESULTS	1
Stripa 'Granite'	2
Westerly 'Granite'	2
DISCUSSION	2
REFERENCES	4

TABLES

No.

1. Comparative modal analyses of Creighton, Stripa, and Westerly rocks	3
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FIGURES

1. Photomicrographs of the Stripa 'granite' specimen	5
2. Photomicrographs of a thin section of Westerly granodiorite showing zoned, altered euhedral to subhedral plagioclase in anhedral K-feldspar, slightly deformed quartz, scattered biotite and magnetite	6

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by

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INTRODUCTION

The study of the thermophysical properties of rocks at normal pressures must be extended to higher pressures, in order to predict with more confidence the potential stability of rocks in heated underground openings such as nuclear waste disposal sites. Toward this end, CANMET is working with the Lawrence Livermore Laboratory to obtain thermal diffusivity information on rocks subjected to triaxial stresses up to 200 MPa. The rocks selected for preliminary tests are two samples from the well known Stripa, Sweden and Westerly granitic plutons, and one from a quartz diorite massif in the Creighton mine, Ontario.

Following is a petrographic description of the two granitic specimens to be used in the thermal tests. The petrography of the Creighton rock has been described previously (1).

PROCEDURE AND RESULTS

Stripa 'Granite' (Thin section TS-1-82)

A modal analysis of the thin section (Table 1) indicated that the Stripa specimen is granitic to quartz monzonitic in composition, as other studies have shown (2). Megascopically, it is of medium grain size, coarsely homogeneous with discrete grains of quartz, potassium (K) feldspar and lesser plagioclase, and minor scattered ferromagnesian minerals. The thin section reveals, however, that the texture, perhaps once hypidiomorphic granular, is now cataclastic. The large crystals, both quartz and feldspars, are multicrystalline anhedral mosaics that were apparently modified during intense deformation. Quartz has been pulverized locally, particularly near fragmented feldspars. Grain boundaries are often serrated, suggesting some possible late recrystallization. Most crystals have been warped and have retained a wavy

extinction; only large muscovite crystals appear intact. Fracture traces are common, usually following grain boundaries; some are infilled with indigenous minerals, principally quartz and chlorite, rarely with epidote. Some features are illustrated in Figure 1.

Much of the plagioclase (An_6) appears to have been intergrown originally with K-feldspar (microcline), but discrete subhedra are also common. The plagioclase is dusted with sub-micron particles, perhaps an early deuteric micaceous phase; microcline is fresh. Muscovite is also unaltered, but chlorite appears to have formed after biotite or perhaps other ferromagnesian minerals.

Westerly 'Granite' (Thin section TS-2-82)

The Westerly 'granite' sample is a fine-grained, homogeneous rock with an equigranular, hypidiomorphic texture. The modal composition (Table 1) is closer to granodiorite than granite. Plagioclase feldspar is euhedral to subhedral, occasionally poikilitic within but not intergrown with anhedral/potassium feldspar crystals. Both feldspars are strongly zoned; the central sections of plagioclase are irregularly clouded with sub-micron dust, in part micaceous, but the K-feldspar is mostly clear. Biotite, the only primary ferromagnesian silicate observed, occasionally has chlorite lamellae. Accessory minerals are muscovite, magnetite with biotite, and rare apatite, zircon or sphene. Figure 2 shows the details. No extensive fractures were observed in this sample, but quartz grains often have a wavy extinction of a few degrees, suggesting that the rock had once been stressed.

DISCUSSION

The two granitic rocks, because of their compositional and textural dissimilarities, may behave differently under thermal stress. The Westerly specimen should have the thermal characteristics of homogeneous granodiorites, but the Stripa sample may not have the thermal properties of similar granites because of its distinctly cataclastic texture. Neither will behave like the compositionally different Creighton quartz diorite (3,4).

Table 1 - Comparative modal analyses of Creighton, Stripa, and Westerly rocks

	Creighton Q-Dior		Stripa 'Granite'		Westerly 'Granite'	
	%	Gr. size	%	Gr. size	%	Gr. size
Plagioclase (An)	(41) +40	0.1- 5 mm	(11) 26	0.4- 3.5 mm	(15) 37	0.2- 2.5 mm
K-Feldspar	--		33	0.1- 2.0	29	0.2- 2.0
Quartz	8-16	0.05- 5	31	0.02- 1.5	18	0.1- 1.3
Muscovite	--		6	0.3- 2.5	4	0.1- 0.5
Amphibole	±29	0.05- 5+	--		--	
Biotite	12	0.1- 6	1	<2	9	0.4- 1.3
Scapolite	1-11	0.1- 5	--		--	
Apatite, sphene etc.	<0.5	0.01- 1	--		<0.1	<0.4
Oxides, sulphides	0.5-3	0.01- 3	--		1.5	0.2- 1.0
Chlorite, alt. mica	<0.5	0.05- 0.5	3	0.02- 1.2	0.5	<0.2

(An) = Anorthite content

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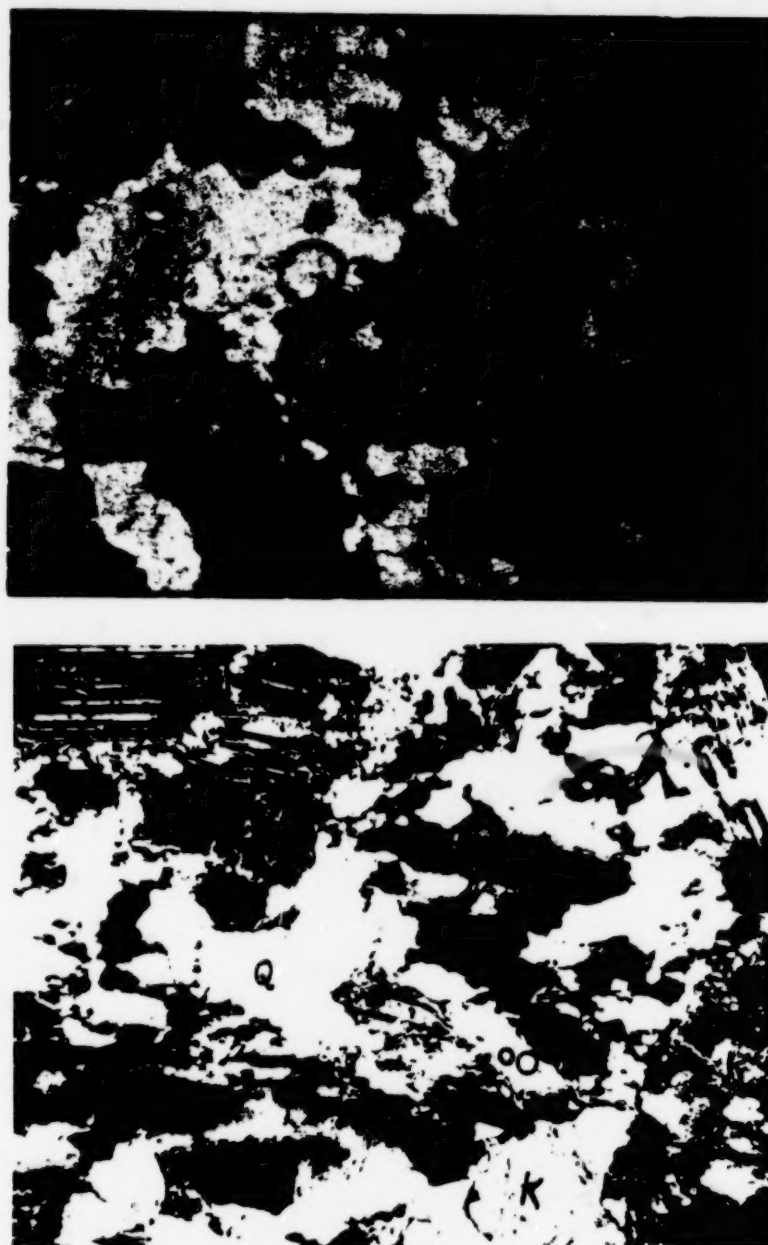


Fig. 1 - Photomicrographs of the Stripa 'granite' specimen.

Top: Plane light, showing coarse grains of quartz (Q), K-feldspar (K) with plagioclase (Pl) and chlorite smears (dark). Magnification 15X.

Bottom: Crossed polarizers, revealing the multicrystalline mosaics, serrated grain boundaries, wavy extinction of quartz and fragmented feldspar grains. Magnification 25X.



Fig. 2 - Photomicrographs of a thin section of Westerly granodiorite showing zoned, altered euhedral to subhedral plagioclase in anhedral K-feldspar (K), slightly deformed quartz (Q), scattered biotite and magnetite (dark).
Top: Plane light. Bottom: Crossed polarizers. Magnification 25X.